



Academic libraries as the flagships of publishing trends in LIS: a complex analysis of rankings, citations and topics of research

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ABSTRACT

The aim of this paper is to identify the most prevailing trends of research and publishing in the field of Library and Information Science (LIS) based on the publications of the past five years. The study follows a complex methodology. First, the scope of the journals to be analysed were defined, using the results of the Scimago Journal Rank (SJR) from the period between 2013 and 2017, and then their most cited articles were selected based on Web of Science (WoS) data. During the selection process we performed a comparative analysis of the journals as well, involving several criteria, to be able to finally choose 632 articles, published between 2014 and 2018 to be included in our research sample. We then examined (1) the authors occurring most frequently, (2) the most often cited articles, (3) the institutions with the highest publication activity, (4) the most common topics based on titles, keywords, and abstracts, and (5) the connections between all of the above. The results of the analyses provide an international overview and assessment of the leading research topics and the most prominent representatives of LIS, all of which are directly connected to the notion and the activities of academic libraries.

Introduction

In the past 25 years the aggregated annual publication output of LIS nearly doubled (Vijayakumar and Kolle, 2017). The increase in the number of published articles does not imply that all papers have the same effect on academic life, or that these publications represent the undistorted results of all ongoing research, void of publication bias (Shadish et al., 2016).

Different fields of science have different publication and citation practices; for example, the authors of molecular biology cite each other and publish a lot more frequently than mathematicians do (Moed and Plume, 2011). Therefore, when it comes to the assessment of different fields, unique characteristics play a very important role. LIS researchers, for instance, cite articles and authors most frequently in their own discipline (Chang & Huang, 2012).

In our study we aim to identify the main trends and most popular topics which define the avenues of research and publication in LIS over the past five years, based on the examination and content analysis of the most often cited articles published in Q1-rated (Quartile 1 – the top quarter based on ranking) international journals registered in the Library and Information Science category of the SJR Scimago Journal & Country Rank (based on Scopus). The study therefore pursues a

complex, dual-perspective approach: it analyses the publications of the past five years using both ranking and citation data. To evaluate outstanding performance we applied Scimago's quartile rating and Web of Science's (WoS) citation data consecutively to choose the periodicals to be examined. Then from these periodicals we chose the (top 5) most cited articles from each year, according to WoS's data on the day of query (2 May 2019).

First, the theoretical and the research methodological background of the analysis will be presented, which is followed by a systematic analysis of the authors occurring most frequently, the most often cited articles, the institutions with the highest publication activity, the most common topics (based on titles, keywords, and abstracts), and the connections between all of the above in a carefully selected set of altogether 632 articles, published between 2014 and 2018.

This research has been motivated by Blessinger and Frasier's (2007) work, who believe that citation metrics and content analysis can provide the deepest insights into the development of a profession.

Research conducted in the area can be divided into two major groups: (1) works that include nearly all the articles based on the chosen database or other selection criterion; and (2) works that further narrow down the scope of the data by applying another criterion.

Typical selection criteria (that can be combined) are for instance

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most cited articles (Hodonu-Wusu and Lazarus, 2018); articles from journals with high impact factor and/or Q1 or D1 quartile rating in a certain field; articles from prestigious journals; or a set of search results based on queries with certain keywords.

In summary, we aimed to map the most recent research trends of LIS by applying this dual selection methodology (Scimago and WoS) in order to answer the following questions:

Question1: Which authors appear most frequently?

Question2: How many times are the most often cited articles cited, and is there any overlap with the most productive authors?

Question3: Which institution has the highest publication activity?

Question4: Which are the most often referenced topics based on the keywords supplied by the authors?

Question5: Based on expressions/word pairs in the titles, which topics are popular?

Question6: Based on the analysis of the expressions/word pairs found in abstracts, which research topics are the most popular?

Question7: If we examine the words used in titles and abstracts together, are the most popular expressions different?

Question8: Is there a difference between the trends identifiable based on keywords, titles, and abstracts?

Question9: Who are the most prominent authors based on the number of their articles and citations?

By answering these questions we can provide a snapshot of the field of LIS showing which the most current topics are based on citations, who the most popular authors are, and which institutions provide the highest number of outstanding publications.

Literature review

There is a wide range of studies, both of a theoretical and empirical nature (Tuomaala et al., 2014), dealing with the concept of “trends of library and information science”. Some of the analyses focus on research methods or authors (Atkins, 1988; Bauer et al., 2016), while others aim to discover international or local cooperations, or to find exceptional ones. Our work continues the empirical tradition.

In determining the data to be used, four key aspects are to be considered, based on which the various pieces of research can be divided into categories as well: the time scope of the study; the selection criteria of databases/journals, etc.; the selection criteria of articles/documents; the scope of data to be analysed and the method of analysis. The qualities above are the primary, defining factors, which determine within what context and scope the interpretation of the results of a given piece of research can be considered true.

Publications researching LIS trends show a wide variety regarding the examined time scope. There are studies spanning over generations (Saumure and Shiri (2008); Tuomaala et al. (2014)) and works which are able to demonstrate major changes of a given field on the timescale of strategic planning (Bauer et al., 2016; Dora and Kumar, 2017; Baek and Suh, 2017; Lokhande, 2013; Malliari and Togia, 2016; Gore et al., 2009).

Hodonu-Wusu and Lazarus (2018) examined the 500 most cited publications from between 1980 and 2017, based on WoS data. During the analysis of the data from this long period they determined that there were less works published between 1980 and 1997, more between 1998 and 2016, and there was a publication boom in 2016. The most cited authors of the examined period were Birger Hjørland and Mike Thelwall.

Blessinger and Frasier (2007) examined LIS research trends between 1994 and 2004 in their paper. They applied a dual system during the selection of periodicals. As a base they used the 55 periodicals that were available in the LIS category of the Journal Citation Reports (JCR) in 2003, because periodicals appearing in the JCR meet strict quality criteria. The other selection criterion was the Ulrich's Periodical

Directory, which ensured that their research included the top periodicals publishing specifically in the field of LIS according to another set of criteria as well.

Olmeda-Gómez and de Moya-Anegón (2016) assessed LIS researchers linked to European institutions and their affiliations (institutes) regarding the time period between 2003 and 2012. The starting point of their research was the Scimago Institutions Ranking, which is based on Scopus data, but they defined the best periodicals based on SJR. They created a list of the top 40 periodicals of the European Union in which the most European authors were published (Olmeda-Gómez and de Moya-Anegón, 2016).

Studies with the shortest time scopes essentially provide a publication snapshot of the current or past status of a field. Hu et al.'s (2013) study examined the time period between 2008 and 2012 in order to map the current state and developments of the rapidly developing Chinese LIS research. In their study the most important keywords were the following: information service, knowledge management, knowledge service, information resource, digital reference service, digital library, library management, social network, information literacy, and intellectual property, which are discerned according to frequency, co-word data, and correlation network data.

Menendez Echavarria and his colleagues selected articles from the WoS, according to the professional categorization of the WoS-based JCR. In their study covering the period between 2009 and 2013 they examined the LIS research trends of the Ibero-American and Caribbean region based on authors, institutions, countries, topics, etc.: “the paper reports on a mixed-methods study that integrated quantitative and qualitative analysis by bringing together bibliometric techniques and procedures combining the measurement of variables and the retrieval of scientific production indicators.” (Menendez Echavarria et al., 2015, pp. 2).

The focus of analysis can include keywords/subject headings and their frequency; the summary or the entire text; authors and their numbers; the number and analysis of bibliographic items; citations; classification of the area of study; countries; institutions; and journals. In many cases, a data set clearly defined and selected based on the above provides the set of data to be analysed.

Jabeen et al.'s (2015) study analyses the expressions appearing in titles and keywords. The ten most frequently used keywords they identified were internet, libraries, digital libraries, information retrieval, information, world wide web, library, behaviour, academic libraries, and science.

A common method in keyword-based content analysis and trend research is the so-called co-word analysis performed on keywords, titles, abstracts, or even whole texts. This method aims to reveal how frequently a certain pair of words occurs in a publication (Callon et al., 1983). With the help of current technology, it is not difficult to find and count units of 3, 4, 5, or even more words. As the examples above show, the frequency analysis of words has a long tradition in research aimed at the trends of topics of any given scientific field.

Methods

In order to examine the research trends of LIS we set a short time frame to determine the scope of data to be studied: the period between 2014 and 2018 covers five years. We are aware that in several cases the time elapsed between the publication of the articles and their inclusion in the study is not very long, but we deemed this time period the most suitable for mapping the current status of the field.

When it comes to academic publications, distribution preceding the publication of the finalised form (e.g. article in press, online first) helps the publication date of the first citing articles to be earlier than usual. (Nowadays it is not uncommon for the citing article to be published at an earlier date than the cited article itself.)

For example, Table 1 shows that on 25 May 2020 the number of 2020 LIS publications was 2248 in the WoS. On this day 12% of the

Table 1
Representation of LIS publications published in 2020 in the WoS on 25 May 2020.

| Database | Category | Number of articles | Number of cited articles | Most citers |
|--------------------------------|---|--------------------|--------------------------|-------------|
| Web of Science Core collection | Information science and library science | 2248 | 274 | 23 |

articles, specifically 274 of them already had citing articles that quoted them. The highest number of citations linked to one article was 23.

In light of the above we believe it was not too soon to include 2017 and 2018 publications in this research. Due to the dates of publication and the dates of the evaluation of the number of citations being so close, with our selection method we prevented the earlier publications from being overrepresented compared to the more recently published ones. To this end, we did not choose the most cited works from the entire examined period, but selected the most cited articles from each year on the day of the analysis.

The database used

As mentioned earlier, this study pursues a novel methodology for sample selection and is based on journals processed in the Library and Information Science category of SJR. SJR is built on the Scopus database of Elsevier Publishing Company, but its calculations are based on the algorithm of Google Page Rank (SJR, 2019) – contrary to JCR (JCR, 2019), which includes impact factor as well, and is created from the data of the WoS, currently by the Clarivate Analytics Publishing Company.

In the past five years there were 84–88 journals included in the LIS category of the JCR each year (Information Science & Library Science, 2019), and 225–228 in that of the SJR. There are nearly three times as many journals included in the SJR's LIS category as there are in the JCR's LIS category, and in SJR there are slightly more than 50 journals assigned to each quarter based on quartile values. It is considered an advantage of the SJR that it processes journals from a wider range than JCR does, which is supported by the aforementioned numbers related to the field of Library and Information Science. Altogether 80% of the Q1-rated journals serving as the basis of our study have impact factors and/or are registered in the WoS as well, as shown in Fig. 1.

In the analysis, we identified the publishing countries of the Q1-rated journals and examined the extent to which the list of countries and the number of journals published by them vary each year.

Between 2015 and 2017 half of the Q1 group's journals were published in the United Kingdom, and one third in the USA. The remaining one sixth was divided between three European countries (the Netherlands, Germany, and Spain) and Canada.

As the data shows, there has been no significant change over the past three years in the number of Q1-rated journals published each year by any given country. There is an obvious tendency, however, of journals included in Fig. 1 (registered in the SJR and appearing in the WoS as well) to show an 80 to 20 ratio, distributed evenly between the countries. As Fig. 1 shows, 80% of the journals in the SJR Q1 category also appear in the WoS, too, merely 20% do not. This 80–20% distribution may be observed in the case of the countries as well: 80% of the journals obtaining a Q1 ranking from a given country in a given year will also be part of the WoS.

The analyses indicate that there is a strong linear relationship between the number of journals obtaining a Q1 ranking in a given year and country and the titles registered from these in the WoS (correlation coefficient 0.997 and app. significance 0.000). Based on this it may be argued that if a country has more Q1 journals, more of these will also be registered in the WoS.

Fig. 2 shows the year-to-year change of the number of Q1 journals compared to the previous year. Based on these data there is a strong positive correlation between the year-to-year changes of titles gaining Q1 rating and titles losing Q1 rating in a given year (correlation coefficient 0.918 and app. significance 0.001). This may be explained by the fact that the number of journals in any given year did not change significantly during the period examined.

Journal selection

Table 2 shows the top five journals in the SJR of any given year in the field of Library and Information Science. Some of them appeared more than once among the top five between 2013 and 2017. From the top six LIS core journals published in 2014 (Nixon, 2014) the College and Research Libraries appeared among the best ones in our current

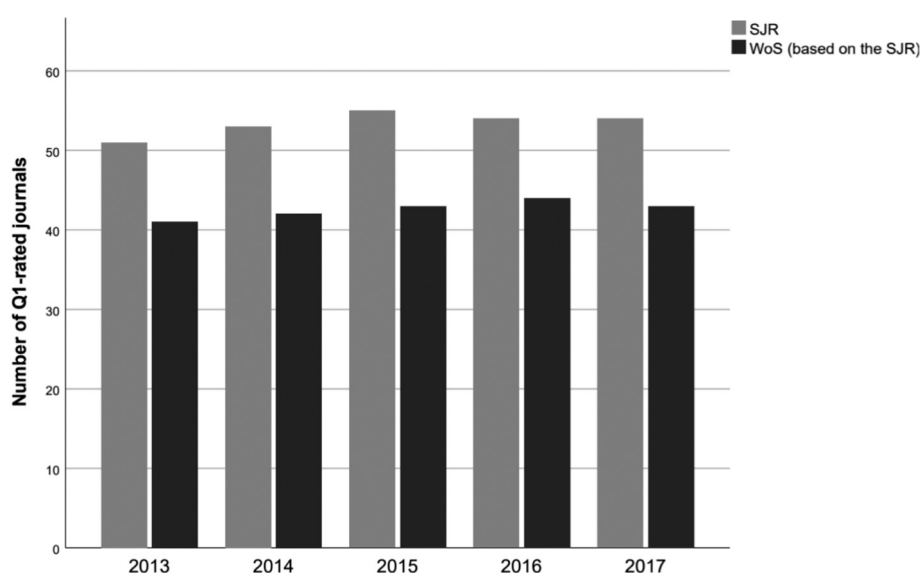


Fig. 1. Q1-rated LIS journals in the SJR and the WoS (based on SJR data) between 2013 and 2017.

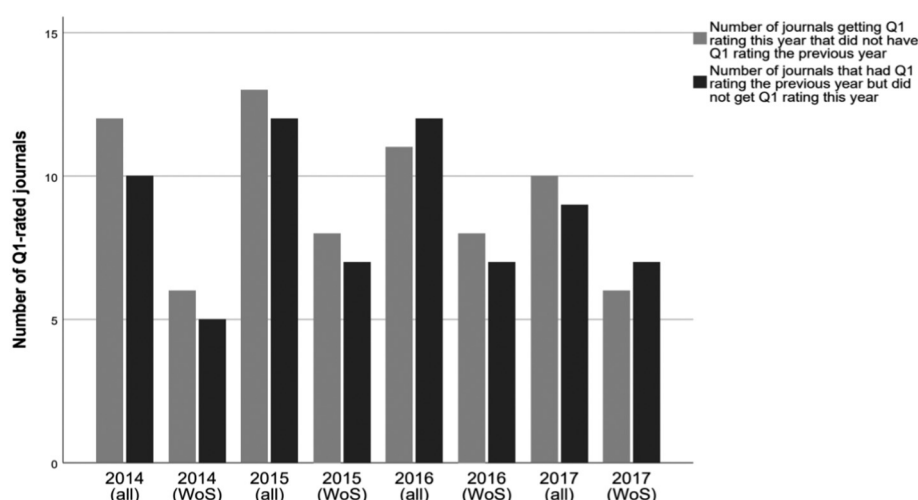


Fig. 2. Changes in the number of Q1-rated LIS journals year by year in the SJR between 2014 and 2017.

study as well, but there were three more titles ranking in the top quarter each examined year (Information Technology and Libraries, Journal of the Association for Information Science and Technology, Library Quarterly).

Between 2013 and 2017, a total of 268 titles were listed as journals with Q1 rating. Two of these were excluded because they are not journals but conference proceedings, and they were included as Q1 journals solely due to their high citation rate. Thus 266 titles remained for these five years, which belonged to 84 different journals.

As Fig. 3 shows, from 84 journals 29 journals were given Q1 ratings in all five years; 8 in four years; 13 in three years; 15 in two years; and 19 in one year. It is easily noticeable that one third of the Q1 journals were among the best every year between 2013 and 2017. This is a compelling argument for considering the articles of these journals particularly important in the field.

Generally speaking, the criterion for choosing the best journals and articles is in many cases – just like with the SJR and the JCR – partially or fully based on their citation metrics, which are calculated using different formulas and algorithms.

It is worth examining the possible correlation between the citation metrics of authors from certain countries and the countries mentioned as the publishers of Q1 journals. According to Hodonu-Wusu and Lazarus's (2018) study, based on the WoS Core Collection, the country with the highest number of citations is the USA, the second is the United Kingdom, the third is the Republic of China, the fourth is Canada, the fifth is Spain, the sixth is Germany, and the tenth is the Netherlands (Hodonu-Wusu and Lazarus, 2018). Based on the data examined in the SJR between 2015 and 2017, these countries published the Q1 journals as well (with the exception of the Republic of China).

Thus far we have investigated the number of Q1 journals published each year in the field of Library and Information Science; the level of representation of the publishing countries; the change of titles year by year; and the top five journals. Based on these results it may be argued

with considerable confidence that if we aim to identify popular trends, we should focus on the top five journals among the Q1-rated publications of the past five years, or those that appeared in the top quarter in all five years.

During the course of the study, with regard to the journals, two selection criteria were applied simultaneously:

- (1) journals that appeared at least once among the top five journals of the top quarter of the SJR quartile list between 2013 and 2017 (referred to as TOP 5). This criterion yielded 13 journals, the titles of which are enumerated in Table 3.
- (2) journals that had SJR Q1 rating in all five years between 2013 and 2017 (referred to as: Q1 is exactly 5 ×), resulting in 29 journals.

After comparing the two sets of results and removing duplicates, we were presented with a list of 32 titles, shown in Table 3. We also indicated the criterion based on which the various journals were selected.

Altogether 87.5% of the examined 32 journals had impact factor in at least one year between 2013 and 2017. As many as 22 of them had impact factor in all five years; 2 in four years; 1 in three years; 1 in two years; and 5 had no impact factor in either of the examined years. As shown in Table 3, impact factor values can differ widely among Q1-rated journals.

Selection/number of articles – planned and final

We selected the articles to be examined based on the number of citers. Since we chose the journals in reference to the SJR, we picked the articles on the basis of their citation metrics according to the WoS. By doing so we have created the opportunity to conduct a study which yields results in a broader sense, using a mixture of the two different sets of criteria.

Although during the selection of journals we could only take SJR

Table 2
The TOP 5 Q1-rated LIS journals in the SJR between 2013 and 2017.

| | 1st | 2nd | 3rd | 4th | 5th |
|------|------------------|------------------|-------------------------|-------------------|------------------------------|
| 2017 | Inf. Syst. Res. | Sci. Data | Inf. Commun. Soc. | J. Informetr. | J. Inf. Technol. |
| 2016 | Cybermetrics | Inf. Syst. Res. | Sci. Data | Gov. Inf. Q. | Eur. J. Inf. Syst. |
| 2015 | Inf. Syst. Res. | Coll. Res. Libr. | Sci. Data | Inf. Commun. Soc. | Eur. J. Inf. Syst. |
| 2014 | Coll. Res. Libr. | Inf. Syst. Res. | Inf. Organ. | Inf. Commun. Soc. | Libr. Inf. Sci. Res. |
| 2013 | Coll. Res. Libr. | Inf. Syst. Res. | IEEE Trans. Inf. Theory | J. Informetr. | Ann. Rev. Inform. Sci. Tech. |

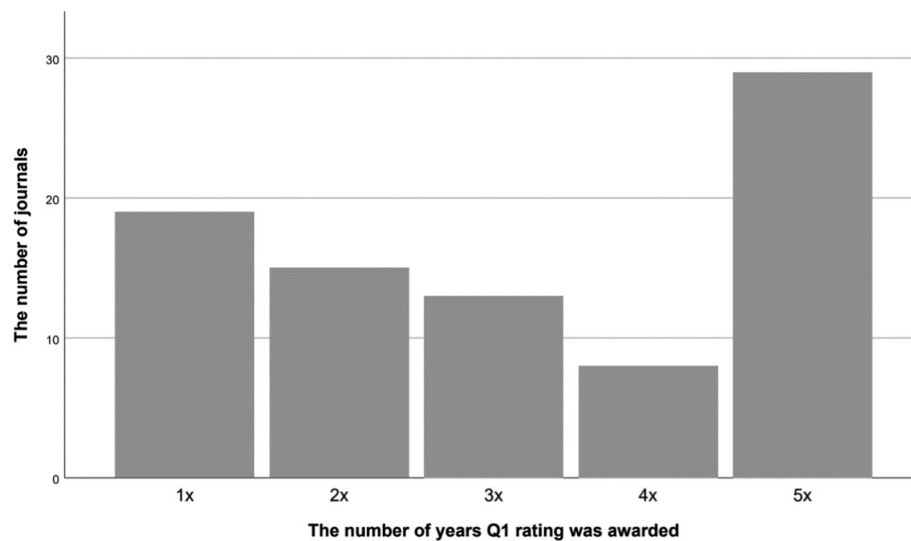


Fig. 3. The number of years journals received Q1 ratings between 2013 and 2017.

Table 3

List of journals (those analysed in the study are highlighted).

| Journal title | Q1-rated | Among the TOP 5 journals | Impact factor (average of years between 2013 and 2017) |
|--|----------|--------------------------|--|
| Scientific Data | | 3× | 5.0375 |
| Journal of Information Technology | 5× | 1× | 5.0105 |
| Journal of Cheminformatics | 5× | | 4.2298 |
| Journal of Chemical Information and Modeling | 5× | | 3.8054 |
| Government Information Quarterly | 5× | 1× | 2.9936 |
| Journal of Informetrics | 5× | 2× | 2.9538 |
| International Journal of Information Management | 5× | | 2.9344 |
| Information Systems Research | 5× | 5× | 2.5738 |
| European Journal of Information Systems | 5× | 2× | 2.555 |
| Journal of the Association for Information Science and Technology ^a | 5× | | 2.3403 |
| IEEE Transactions on Information Theory | 5× | 1× | 2.3158 |
| Scientometrics | 5× | | 2.1722 |
| Information Communication and Society | 5× | 3× | 2.1688 |
| International Journal of Geographical Information Science | 5× | | 2.0142 |
| Social Science Computer Review | 5× | | 1.9954 |
| Information and Organization | 5× | 1× | 1.9248 |
| Information Processing and Management | 5× | | 1.9132 |
| Journal of Health Communication | 5× | | 1.7522 |
| Research Evaluation | 5× | | 1.7378 |
| Annual Review of Information Science and Technology | | 1× | 1.727 |
| College and Research Libraries ^a | 5× | 3× | 1.4496 |
| Library and Information Science Research | 5× | 1× | 1.2648 |
| Journal of the Medical Library Association | 5× | | 1.174 |
| Journal of Documentation | 5× | | 0.9882 |
| Journal of Academic Librarianship | 5× | | 0.9836 |
| Information Technology and Libraries ^a | 5× | | 0.7915 |
| Library Quarterly ^a | 5× | | 0.7134 |
| College and Research Libraries News | 5× | | |
| Cybermetrics | | 1× | |
| Journal of Library Administration | 5× | | |
| New Review of Academic Librarianship | 5× | | |
| Reference Services Review | 5× | | |

^aCore journals (Nixon, 2014).

data from between 2013 and 2017 into consideration, we intended to focus on the most recent publications when choosing the specific articles, therefore we examined the period between 2014 and 2018.

When selecting articles, we used the following settings in the WoS search engine:

- Publication name: title of the journal
- Year: 2018/2017/2016/2015/2014
- Filters applied on the list of results:
 - o Document types: Article
 - o Web of Science Category: INFORMATION SCIENCE LIBRARY SCIENCE
 - o Sort by: Times cited.

We downloaded the top five most cited publications of any given year, except when there were more publications in the fifth place with the same number of citers, in which case all of those were downloaded.

We excluded nine journals out of the 32; five journals contained no LIS-related article in the examined period according to the WoS, and four journals were not registered in the WoS. Therefore, the study ultimately included 23 journals, and 632 articles made it into the scope of the analysis.

Results and discussion

The findings of the analyses will be presented below according to the nine main research questions guiding the investigation.

Question1: which authors appeared most frequently?

We identified 1531 authors linked to the articles. Each article was written by 2.79 authors on average (median: 2.5), and there were 134 publications written by a single author. The highest number of authors linked to a single article was eight. (14 such publications were identified.) Therefore, based on our examination, it may be argued that in the field of library science 22% of the most cited journal articles were written by a single author in the past five years (2014–2018). The statistical analysis of the data, however, does not show a recognizable correlation between the number of authors and the number of citations (correlation coefficient: 0.071).

The author participating in the highest number of articles is Mike

Thelwall (17), followed by Lutz Bornmann (13), Yogesh K. Dwivedi (8), Ludo Waltman (7), and Stefanie Haustein, Kayvan Kousha and Nees Jan van Eck (5–5).

In the study by [Hodonu-Wusu and Lazarus \(2018\)](#), the author with the highest number of articles was Birger Hjørland with 29 publications in the analysed sample, followed by the most productive author in our study, Mike Thelwall with 25 articles.

This is an intriguing concurrence, because in our study we chose the most cited publications of previously selected top journals, which produced highly varied citation metrics, as we will see later on (Question2).

[Fig. 4](#) depicts relationships based on the co-authorship of the authors of the top 5 most cited articles during these five years based on the downloaded WoS dataset, prepared with VOSviewer (a computer program for creating bibliometric maps). As shown in [Fig. 4](#), the authors of the most cited articles were partially co-authors of each other as well, and in some cases we have found even closer links, for instance between Thelwall and Kousha: all of Kousha's publications were written together with Thelwall.

Question2: how many times were the most cited articles cited, and is there any overlap with the most productive authors?

The analysis described below was conducted based on the numbers of the WoS Core Collection Times Cited Count. It should not be forgotten, though, that the basis of the whole study is the appearance of the journals in the SJR, more specifically in the Q1 category.

The downloaded top citation metrics of each year (between 2014 and 2018) varied between 1 and 543 citations among the journals, the average being 23 citers, the median being 12. There were 18 publications in the final sample with more than 100 citers. Ten of these were published in 2014, five in 2015, and three in 2016. Examining the individual cases and the specific numbers, there was no close correlation between the years and the number of citers, but a typical tendency can be seen if we examine the number of articles with more than 100 citers by year: more articles published in the earlier years had higher number of citations than those published more recently.

The correlation between the articles' year of publication and their number of citations was -0.4281 on the whole sample, which indicates that there is no link between the two data items. Although there were typical cases where it was mostly true that articles of earlier years were

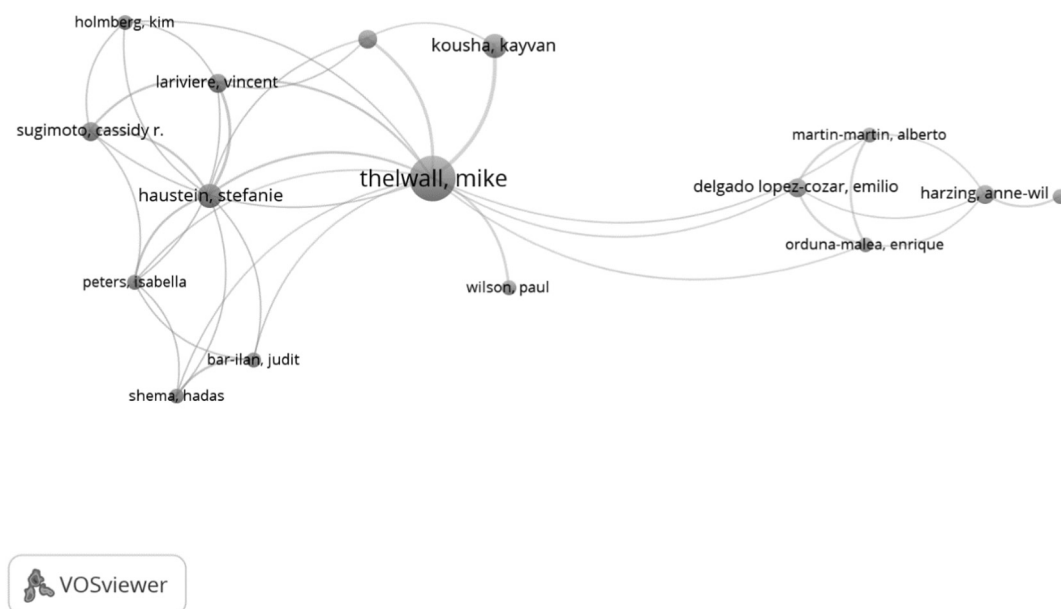


Fig. 4. Relationships based on the co-authorship of authors (minimum 2 articles).

Table 4
Number of average citations per year.

| | 2014 | 2015 | 2016 | 2017 | 2018 |
|------------------|-------|-------|-------|-------|------|
| Avg. citations | 45.95 | 36.16 | 23.27 | 10.71 | 4.21 |
| Median citations | 32 | 26.5 | 15 | 7.5 | 3 |

more likely to be cited more times, we have found many atypical examples as well.

The results showing the average citations per year were different, however, which are shown in Table 4 (average and median values). Based on these data there is a strong negative correlation between the increase of the number of average citations and the date of publication. This means that earlier publications have higher average citation numbers than more recent ones. (The correlation indicator is 0.995 compared with the average and 0.989 with the median values.) This also shows that our methodology is reasonable.

We have also examined the link between the yearly number of citers of each journal counted by articles, and their year of publication. In this case, the correlations varied widely: they ranged between -0.46 and -0.95 . Based on these values there is no correlation between the higher average number of citations and the year of publication.

Among the most productive authors, Mike Thelwall and Stephanie Haustein appear on the list of the most cited articles with one co-written publication (number of citers: 126), similarly to Lutz Bornmann with two articles as well (number of citers: 149 and 104).

The 632 journal articles under scrutiny were cited 14,390 times. There were 37 authors, who received over 100 citations for all of their articles in the sample. The largest cumulative citation number was 888, belonging to Mike Thelwall, followed by Lutz Bornmann (466 citations), Stephanie Haustein (376 citations), Juho Hamari (364 citations) and Rodrigo Costas (with 296 citations). What all this boils down to is that the three authors with the most productive citations and with citations related to the largest number of articles perform outstandingly in the cumulative citation number as well.

Question3: which institution had the highest publication activity?

There were 483 institutions listed in the field of author's affiliations, where one institution could belong to more than one author, because in the case of several authors listed for one article, each workplace was most often indicated only once.

As Table 5 indicates, the most often referenced institution counted by article was the University of Maryland, followed closely by the University of Illinois, then the University of Michigan, the University of Tennessee, the University of Wisconsin and the first non-US university, the Wolverhampton University, where two of the authors appearing most frequently (Mike Thelwall and Kayvan Kousha) work.

The list of the institutions' countries provided by the authors includes 971 items, based on which the significant dominance of the

Table 5
The most frequent affiliations of authors.

| Institution | Occurrences |
|-------------------------------|-------------|
| Univ. Maryland (USA) | 17 |
| Univ. Illinois (USA) | 13 |
| Univ. Michigan (USA) | 13 |
| Univ. Tennessee (USA) | 13 |
| Univ. Wisconsin (USA) | 13 |
| Univ. Wolverhampton (England) | 13 |
| Georgia State Univ. (USA) | 10 |
| Penn State Univ. (USA) | 10 |
| Leiden Univ. (Netherlands) | 9 |
| SUNY Albany (USA) | 9 |
| Univ. Minnesota (USA) | 9 |

USA's institutions (504 items) is evident. From among the 10 authors, nine of them indicated a university as their workplace, and almost half of these (417) were US universities.

Authors included in the top 5 authors with the highest number of published articles (Question1) were not predominantly from the US, however; most of them are Europeans: the first place belongs to the UK with three authors (Thelwall and Kousha from Wolverhampton University and Dwivedi from Swansea University), followed by the Netherlands (Waltmann and Eckel from Leiden University), Germany (Bornmann from the Max-Planck-Gesellschaft) and Canada (Haustein from the University of Montreal).

Fig. 5 neatly illustrates the cooperation between universities, displaying the relations established by co-authors, in cases where authors have published at least four articles together. The majority of universities highlighted in Table 5 appear in Fig. 5 as well, as central figures, cooperating with other institutions, too (e.g., the University of Maryland, Georgia State University, or the University of Wolverhampton).

Question4: which were the most often referenced topics based on the keywords supplied by the authors?

There are 2421 author's subject headings linked to the more than 600 articles in the sample, with 1790 different expressions, more than two thirds of which (63.1%) appear only once. Altogether 661 unique keywords occurred more than once. The most often used expressions are included in Table 6. The expressions can be categorized into different groups: e.g., those related to the assessment of academic publications (*scientometrics*, *altmetrics*, *bibliometrics*, *research assessment*, *citation analysis*), technological expressions (*IoT*, *big data*, *open data*, *cloud computing*, *information*), databases/companies (*WoS*, *Scopus*, *Twitter*), etc.

Expressions occurring most frequently are *academic libraries* (32), *social media* (30), *information literacy* (23), *twitter* (18) and *bibliometrics* (17).

Hodonu-Wusu and Lazarus (2018) examined the subject headers linked to the publications in their study, and identified the most popular expressions. Our findings regarding the five most popular subject headers partially match their results. According to Hodonu-Wusu and Lazarus's analyses, the most popular expression is *academic library*, which is also the first on our list in the form *academic libraries*. The third is *information literacy* in both data sets; in Hodonu-Wusu and Lazarus's study *bibliometrics* was the fourth, on our list it is the fifth.

Taking into consideration the fact that 90% of the authors involved in the analysis indicated a university as their workplace (Question3), it is not surprising that the most frequently occurring expression was *academic libraries*. It appeared in 32 cases, which means that this formed 5% of the keywords appearing more than once.

Question5: based on expressions/word pairs in the titles, which topics are popular?

All in all, 1942 expressions could be identified in the titles. There are 18 expressions appearing at least ten times, most of which do not refer to the topic itself: *academic library*, *effect*, *evidence*, *impact*, *practice*, *research*, *survey*, *case study*, *information*, *library*, *role*, *use*, *analysis*, *comparison*, *science*, *twitter*, *framework*, *information literacy*.

Two-word expressions of this list are: *social media* (24 occurrences), *information literacy* (24), *academic libraries* (21), *academic library* (10), *health sciences* (10), *health literacy* (10), and *information seeking* (10).

It is an interesting outcome that both among the titles and among the subject headers the expression *academic library/libraries* is the first on the list. This shows that among the most cited articles, papers on this specific type of library occur especially often.

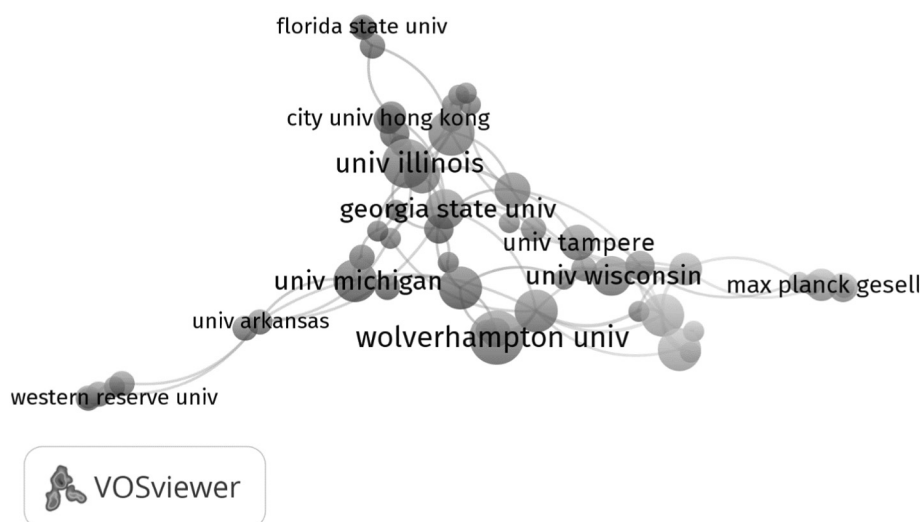


Fig. 5. The relationships between institutions (based on co-authors).

Table 6

The most frequently occurring author's keywords.

| Expressions | Number of occurrences |
|----------------------|-----------------------|
| Academic libraries | 32 |
| Social media | 30 |
| Information literacy | 23 |
| Twitter | 18 |
| Bibliometrics | 17 |
| Altmetrics | 14 |
| Big data | 13 |
| Assessment | 12 |
| Open data | 10 |
| Research evaluation | 10 |
| Web of science | 10 |
| Sentiment analysis | 9 |
| Cloud computing | 8 |
| Collaboration | 8 |
| Sustainability | 8 |
| Case study | 7 |
| Citation analysis | 7 |
| E-government | 7 |
| Information | 7 |
| Internet of things | 7 |
| Library instruction | 7 |
| Scientometrics | 7 |
| Scopus | 7 |

Question6: based on the analysis of the expressions/word pairs found in abstracts, which research topics were the most popular?

There are 12,464 identifiable expressions in the abstracts. The 20 most popular ones are: *framework, information, librarian, library, paper, role, student, study, analysis, article, author, impact, research, researcher, data, model, technology, use, user, time* (at least 84 occurrences).

The most popular word pairs are *academic library* (14), *information literacy* (13), and *academic libraries* (13).

Question7: if we examine the words used in titles and abstracts together, are the most popular expressions different?

We also examined the trends based on the frequency of words appearing in titles and abstracts: *information* (234), *library/libraries* (211), *social* (178), and *academic* (97).

The most popular two-word expressions are *information literacy* (37), *academic libraries* (34), *social media* (30), *academic library* (23),

information seeking (20), *big data* (13), *information science* (11), *public libraries* (11), *research libraries* (10), and *health science* (10).

Question8: is there a difference between the trends identifiable based on keywords, titles, and abstracts?

It is an interesting question regarding the abstracts' contents how much the abstract itself reveals which does not generally contain the same expressions as the author's keywords (Table 7). An interesting outcome of the analysis is that in the examined data set the results most similar to the author's keywords were obtained by the simultaneous examination of titles and abstracts. While when they were investigated independently, the data produced different results, but when they were analysed together, similar results were obtained. Topics appearing in the most frequently used keywords are identical with those communicated in the titles and the abstracts: e.g., *information literacy, academic library/academic libraries and social media* (highlighted in Table 7).

Question9: who are the most prominent authors based on the number of their articles and citations?

Table 8 shows a summary indicating that based on Question1 and Question2 there are three authors who are prominent according to the number of both their publications and their citations. Two of the authors work for different universities, while the third one works for a research institution. Among them, Mike Thelwall and Stephanie Houstein have two co-written articles, therefore there are 33 different publications altogether.

The distribution of the 33 articles between the years is as follows: 12 of them were published in 2014, 5–5 in 2015 and 2017, 4 in 2016, and 5 in 2018. The average number of citers calculated based on these articles is 46.88 (median: 41).

In the case of the publications by the three authors, one article had 5 keywords on average (the highest value was 10). As far as frequency goes, the most popular expressions were *altmetrics* (9), *bibliometrics* (6), *scientometrics* (5), and *webometrics* (4), which were present at more than half of the 33 publications, in different combinations or by themselves. Other popular expressions included *Twitter* (3), *broader impact* (2), *citation analysis* (2), *citation counts* (2), *excellent papers* (2), *F1000* (2), *highly cited papers* (2), *Mendeley* (2), *most frequently cited papers* (2), *Societal impact* (2), *top cited papers* (2), and *Web of Science* (2).

Some of the frequently used expressions are specifically linked to

Table 7
The most common expressions in keywords, titles, and abstracts.

| WoS keywords | OCC | Titles | OCC | Abstracts | OCC | Title + Abstract | OCC |
|----------------------|-----|----------------------|-----|----------------------|-----|----------------------|-----|
| academic libraries | 32 | social media | 24 | academic library | 14 | information literacy | 37 |
| social media | 30 | information literacy | 24 | information literacy | 13 | academic libraries | 34 |
| information literacy | 23 | academic libraries | 21 | academic libraries | 13 | social media | 30 |
| twitter | 18 | academic library | 10 | | | academic library | 23 |
| bibliometrics | 17 | health sciences | 10 | | | information seeking | 20 |
| altmetrics | 14 | health literacy | 10 | | | big data | 13 |
| big data | 13 | information seeking | 10 | | | information science | 11 |
| assessment | 12 | | | | | public libraries | 11 |
| open data | 10 | | | | | research libraries | 10 |
| research evaluation | 10 | | | | | health science | 10 |
| web of science | 10 | | | | | | |

Abbreviation: OCC - number of occurrences.

Table 8
Most productive authors based on number of articles and citations.

| | Nr. of articles | Most cited article/s | Cumulative citation |
|--------------------|-----------------|----------------------|---------------------|
| Mike Thelwall | 17 | 126 ^a | 888 |
| Lutz Bornmann | 13 | 149 and 104 | 466 |
| Stephanie Haustein | 5 | 126 ^a | 376 |

^a The most cited article co-written by Thelwall and Haustein.

the field of libraries of universities or research institutions, such as the assessment of academic achievements or research support.

Conclusions

This paper aimed to identify the most prevailing trends of research and publishing in the field of Library and Information Science (LIS) based on a systematic, dual-perspective analysis of the publications of the past five years, involving both ranking and citation data. The study worked with a novel method in selecting the research sample. The selection procedure differed from the criteria applied in earlier studies, where the data set included the most cited publications of a given period of time. Based on the findings presented above, it may be argued that the dual system of criteria demonstrated here is capable of offering more insights than those of previous studies, because it combines (1) the categorization and ranking results of the SJR with (2) the citation data of the WoS.

It is important to note regarding the present study that it used citation numbers between 1 and 543, which is a wide range. This provided us with the opportunity to choose from articles published in any given year, therefore the results were less distorted by the fact that articles published a few years earlier had more time to be cited until the day of the study. This was especially true in the case of articles published in 2017 and 2018.

Using this new methodology, this study identified the most popular topics and the most often cited authors of LIS over the past five years, which may be claimed to play a decisive role in determining the main avenues of research in the field.

With our research we have taken a snapshot of the period between 2014 and 2018. We used a two-step selection approach to choose 22 periodicals, from which the 5 most cited articles of each year were included in the scope of the analysis. Due to equal numbers of citations we have examined 632 publications instead of 550.

In our study we have identified authors who can be considered outstanding based on both the number of publications examined, and the number of citations linked to these works. Among the top 5 authors with the most publications Mike Thelwall (Wolverhampton University), Lutz Bornmann (Max-Planck-Gesellschaft), and Stephanie Haustein (University of Montreal) have at least one article with over 100 citations, and all three of them proved to be outstanding based on the cumulative citation number of their examined articles as well. They are the ones who published a large number of articles during the analysed time period, and their articles had great impact. The subject matter of the examined articles of these three authors were mostly related to different metrics (e.g. altmetrics, bibliometrics, scientometrics, webometrics).

An in-depth analysis of the keywords, the titles and the abstracts of the articles suggested that the most prevailing tendencies of research relate dominantly to academic libraries, but social media and information literacy also have a significant role. The investigation was also capable of highlighting correlations (or the lack of correlations) between certain phenomena, such as the (potential) relationship between the number of authors and the frequency of citations, the number of citations and the year of publication or the institutional affiliation of the author(s), etc. The results provide evidence for the fact that the variables analysed (e.g., topics, institutions, authors) can be seen as possible indicators of publication activity and bibliometric impact.

Author statement

Péter Kiszl: Conceptualization, Methodology, Writing - original draft, Writing - review & editing, Supervision. **Bea Winkler:** Methodology, Formal analysis, Investigation, Resources, Data curation, Writing - original draft, Writing - review & editing, Visualization.

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